

PHYSICS WITH TRANSFORMS

BY
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Table of Contents

Wednesday, June 30, 2010
9:43 PM

INDEX

| | |
|--|------------|
| Explanation of the Scientific Chart..... | Page one |
| The TRANSFORM..... | Page two |
| PHYSICS WITH TRANSFORMS..... | Page three |
| Experimental Installations | Page four |
| Chart of Mathematics..... | Page five |
| Algebra and Geometry..... | Page six. |

Explanation & How-To Use

Wednesday, June 30, 2010

9:45 PM

EXPLANATION AND HOW TO USE: THE SCIENTIFIC CHART OF PHYSICS WITH TRANSFORMS.

The Scientific Chart has three columns: the column at the left are Experimental Installations, where formulas come from, these formulas form Ratios along the sides of the two Similar Triangles in the Geometric Diagram.

The column at the center are the Geometric Diagrams formed by two Similar Triangles, the value of the Ratios from the Experimental Formulas, are written near the vertex of its angle, and they are noted as in Mechanics: $=F$, $=m$, $=a$. Mathematically Ratios form Proportions where New Formulas are deduced.

The column at the right are the TRANSFORMS. The Transform is figured as a rectangular line, where outside up at the left is the Mathematical Operator \mathcal{P} , this operator is read as: "proportionally", it identifies only the Mathematical Procedure of the Transform.

Up inside in the Rectangle are the three Formulas taken from the Experimental Installation, inside down are the two Formulas derived from the mathematical transformation.

If You want to know the foundation and derivation of a Transform study the Geometric Diagram. The TRANSFORMS work like a Periodic Table of Physics. Formulas are grouped so You can memorize them easily.

The Table is mnemotecnic. Each Transform works sixteen formulas.

A cable hanging a bridge conducts force the same way a wire conducts electricity. Formulas are similar in a path of conduction. Conduction of gas, liquid, oil, heat, force, electricity, magnetism, light, radiation and so on.

In Mechanics You have the Force of pressure and pulling, and the gravitational Force which mantein the Universe in Equilibrium. In Thermology You have the Force of dilatation. In Electrostatics You have the Force of atraction, the same in Magnetism. Force produce Energy in its movement. The TRANSFORMS link these Forces.

You can get important fundamental formulas in Mechanics, Elasticity, Viscosity, Thermology, Thermodynamics, Electricity, Electrostatics, Electrodynamics, Electromagnetism, Electromagnetodynamics.

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The Transform

Wednesday, June 30, 2010

9:47 PM

THE TRANSFORM.

This is the Mathematical Development of the TRANSFORMS. The Transform is a Formula that is applied to Physics: in the SCIENTIFIC CHART OF PHYSICS WITH TRANSFORMS.

\mathcal{P} is a Mathematical Operator, and it is readen as: Proportionally the Five Formulas of the Transform are taken from the Two Similar Triangles in the Geometric Diagram.

The Operator \mathcal{P} distinguishes the Mathematical Procedure. The Letters are Lengths of Lines taken at a Scale of Magnitudes in a Metric System of Units. The Five Formulas enclosed in a Rectangle form a Set Named and Identified by the Operator \mathcal{P} . The Operator \mathcal{P} guides the mathematical operation.

Formulas are connected by means of the Transforms, Energy and Force are related Mathematically through all the Formulas of the Physics Science.

This method of linking all Formulas of Physics is elegant and scientific, and mathematics are the beauty and essence of sciences; the Transform does the job.

The Five Formulas of each Transform works simultaneously in the same experiment or application. From the first three formulas of the Transform are deduced two more formulas.

The Scienfic Chart of Physics with Transforms, works more than one hundred formulas.

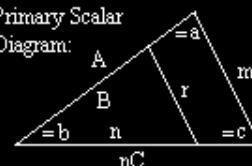
The obverse of this page is the EXPLANATION OF THE SCIENTIFIC CHART OF PHYSICS WITH TRANSFORMS.

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TRANSFORMS. Foundation:

Primary Scalar

Diagram:



Ratios of Similitude:

$$\frac{A}{m} = a, \quad \frac{B}{n} = b, \quad \frac{nC}{m} = c. \quad (1)$$

The Proportion:

$$\frac{A}{nC} = \frac{B}{n}; \quad \text{from where: } A = BC. \quad (2)$$

Substituting (1) in (2) we get:

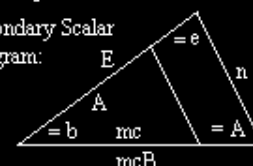
$$ma = nb \frac{mc}{n}; \quad \text{from where: } a = bc.$$

$$\mathcal{P} \quad \begin{array}{l} A = ma, \quad B = nb, \quad C = \frac{m}{n} c. \\ \text{Primary Ecuations.} \\ A = BC, \quad a = bc. \\ \text{Secondary Ecuations.} \end{array}$$

Primary Transform

Secondary Scalar

Diagram:



Combining: $A = ma$ and $a = bc$

gives: $A = mcb$ or $\frac{A}{mc} = b.$

Combining: $A = BC$ and $C = \frac{m}{n} c$

gives: $B = \frac{n}{mc} A$ or $\frac{mcB}{n} = A.$

The Ratios of Similitude are:

$$\frac{E}{n} = e, \quad \frac{A}{mc} = b, \quad \frac{mcB}{n} = A. \quad (3)$$

The Proportion:

$$\frac{E}{mcB} = \frac{A}{mc} \quad \text{from where: } E = AB. \quad (4)$$

Substituting (3) in (4) we get

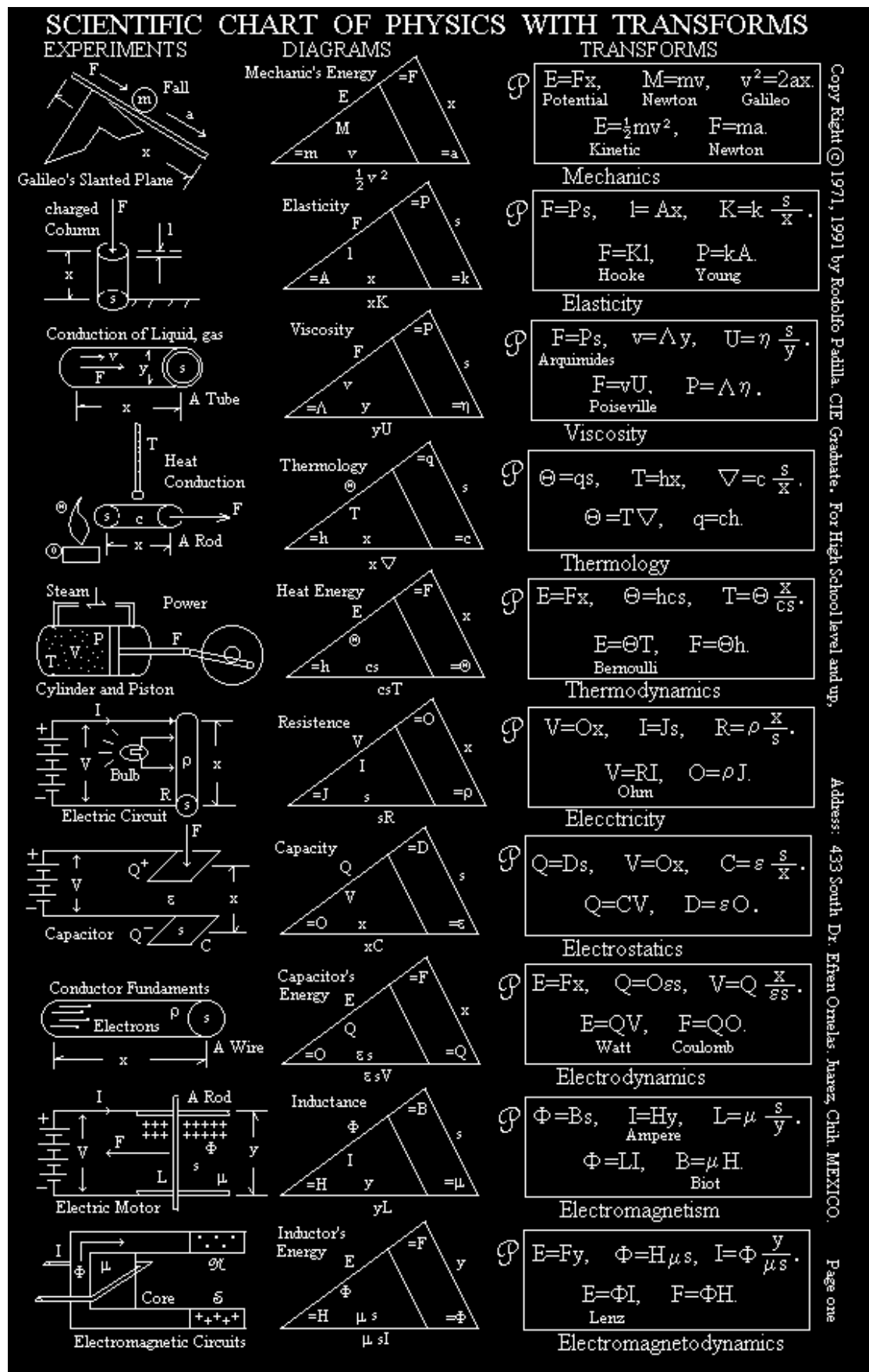
$$ne = mcb \frac{An}{mc} \quad \text{from where: } e = Ab$$

$$\mathcal{P} \quad \begin{array}{l} E = (n)e, \quad A = (mc)b, \quad B = \frac{n}{mc} A. \\ E = AB, \quad e = Ab. \end{array}$$

Secondary Transform

Scientific Chart of Physics with Transforms - side 1

Wednesday, June 30, 2010
9:49 PM



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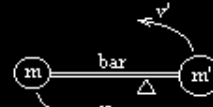
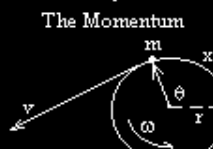
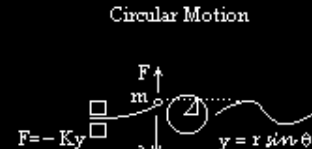
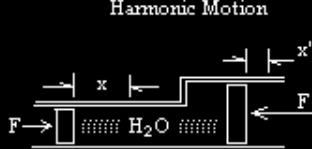
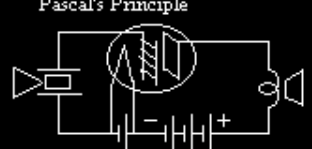
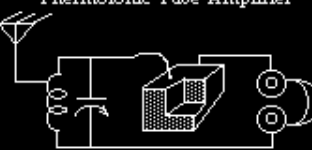

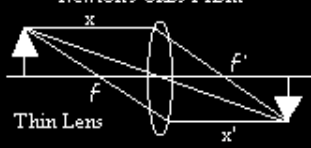
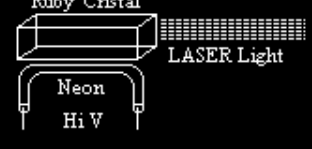
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Page one

Scientific Chart of Physics with Transforms - side 2

Wednesday, June 30, 2010

9:52 PM

| SYMBOL MAGNITUDE, UNIT | EXPERIMENTAL INSTALLATIONS | LAWS AND MATHEMATICAL FORMULAS |
|---|---|--|
| 1 E energy, joule 2 F force, newton 3 x length, meter 4 M momentum 5 m mass, kilogram 6 v speed 7 a acceleration 8 M torque 9 y length, meter 10 t time, second 11 τ period, second 12 P pressure 13 s area 14 l elongation, meter 15 A elastic gradient 16 K rigidity 17 k Young's modulus 18 f frequency, cycle hertz 19 π pi: 3.141592654 20 λ wave length, meter 21 Δ viscous gradient 22 U viscosity 23 η viscous coefficient 24 D specific density 25 r radio, metro 26 @ heat, calory 27 q thermic density 28 T temperature, degree 29 h thermic gradient 30 ∇ thermic conductor 31 c conductivity 32 V volume 33 I current, ampere 34 J electric density 35 V potential, volt 36 Q charge, coulomb 37 O electric gradient 38 R resistance, ohm 39 ρ resistivity 40 D electrostatic density 41 C capacity, farad 42 ε capacitvity 43 φ flux, weber 44 B magnetic density 45 H magnetic gradient 46 μ permeability 47 L inductance, henry 48 θ angle, radian degree 49 ω angular velocity 50 W power, watt 51 f focal distance 52 γ' attraction constant 53 ε' attraction constant 54 μ' attraction constant 55 sin 56 cos 57 Σ sigma 58 ∅ mathematical operator |  <p>Archimedes' Lever</p>  <p>The Momentum</p>  <p>Circular Motion</p>  <p>Harmonic Motion</p>  <p>Pascal's Principle</p>  <p>Thermoionic Tube Amplifier</p>  <p>Galena Crystal Detector</p>  <p>Newton's Glass Prism</p>  <p>Thin Lens</p>  <p>Ruby Crystal Neon Hi V LASER Light</p> | <p>Torque's Law: $FR = F'P = M$. Kind at Center: ARP mnemotecnica. A=Fulcrum, R=Resistance, P=Effort. 1st. 2nd. 3rd.</p> <p>Statics</p> <p>Momentum's Law: $mv = m'v' = M$. Equilibrium's Law: $\Sigma F_{x, y, z} = \text{zero}$.</p> <p>Dynamics</p> <p>Linear and Circular Motion: $v = \frac{x}{t}$, $a = \frac{v}{t}$, $\omega = \frac{\theta}{t}$, $\alpha = \frac{\omega}{t}$.</p> <p>Kinematics</p> <p>$x = \theta r$, $v = \omega r$, $a = \alpha r$, $\omega = 2\pi f$, $f\tau = 1$, $c = 300000K m$, $v = f\lambda$.</p> <p>Circular Formulas</p> <p>Boyle Mariotte's Law: $PV = P'V'$. Charles Guy Lussac's Law: $\frac{V}{T} = \frac{V'}{T'}$. General Law of Gases: $\frac{PV}{T} = \phi$.</p> <p>Gases Laws</p> <p>$F = \gamma' \frac{mm'}{r^2}$, $F = \epsilon' \frac{QQ'}{r^2}$, $F = \mu' \frac{\phi\phi'}{r^2}$. Newton. Coulomb.</p> <p>Atraction Laws</p> <p>Kirchhoff's Laws: $V_1 + V_2 + \dots + V_o = \text{zero}$. $I_1 + I_2 + \dots + I_o = \text{zero}$.</p> <p>Potential & Current</p> <p>$I = \frac{Q}{t}$, $W = \frac{E}{t}$, $\rho = \frac{m}{V}$. $\angle_{inc} = \angle_{ref}$ density light's reflection law</p> <p>Current & Power</p> <p>$\frac{1}{f} = \frac{1}{x} + \frac{1}{x'}$, $\Sigma = \frac{\sin \theta}{\cos \phi}$. Gauss's Lens Law: Snell's Law:</p> <p>Refraction of Light</p> <p>$E = RI^2$, $E = \frac{1}{2} LI^2$, $E = \frac{1}{2} CV^2$. $E = \frac{1}{2} KI^2$ circular $E = 2m\pi^2 f^2 l^2$ undulating</p> <p>Energy Formulas</p> |

∅ is an Operator readen Proportionally the five formulas of the Transform are taken from the two similar triangles of the Diagram. See CHART OF MATHEMATICS.

Chart of Mathematics - side 1

Wednesday, June 30, 2010

9:54 PM

CHART OF MATHEMATICS

QUADRATIC EQUATIONS

PURE QUADRATIC: find roots:

$$ax^2 + c = 0 \quad \text{zero}$$

$$x_1 = \sqrt{-\frac{c}{a}}, \quad x_2 = -\sqrt{-\frac{c}{a}}.$$

MIX QUADRATIC:

$$ax^2 + bx = 0.$$

$$\text{Factorize: } x(ax + b) = 0$$

$$x_1 = 0, \quad x_2 = -\frac{b}{a}.$$

COMPLETE QUADRATIC:

$$x^2 + bx + c = 0$$

Make: $b = m + n$ and: $c = mn$.

Find a pair of numbers such that:

$$x^2 + (m+n)x + mn = 0.$$

$$\text{so: } x_1 = -m, \quad x_2 = -n.$$

COMPLETING THE SQUARE:

$$x^2 + bx + c = 0 \quad \text{and do:}$$

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = -c + \left(\frac{b}{2}\right)^2$$

$$x_{1,2} = \pm \sqrt{\left(\frac{b}{2}\right)^2 - c} - \frac{b}{2}.$$

BY GENERAL FORMULA:

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

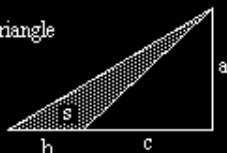
AREA OF TRIANGLE

s area of triangle

a height

c cateto

b base



$$\frac{(b+c)a}{2} - \frac{ca}{2} = s$$

Solving and Simplifying:

$$\frac{ba + ca - ca}{2} = s$$

We arrive to the Formula of the Area of the Triangle:

$$s = \frac{ba}{2}$$

MATRICES

Simultaneous Equations:

Solve for: x , and y :

$$ax + by = m \quad (1)$$

$$cx + dy = n \quad (2)$$

Multiplying (1) by d ,

and (2) by b : thus:

$$adx + bdy = md \quad (3)$$

$$cbx + bdy = nb \quad (4)$$

multiply by -1 (4)

to change the signs, thus:

$$-cbx - bdy = -nb \quad (5)$$

adding (3) and (5) gives:

$$adx - cbx = md - nb \quad (6)$$

expliciting x in (6) we arrive to:

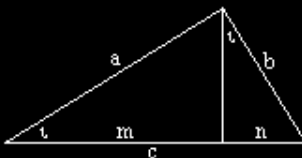
$$x = \frac{md - nb}{ad - cb}, \quad y = \frac{an - cm}{ad - cb}.$$

Algebraic Form

$$x = \frac{\begin{vmatrix} m & b \\ n & d \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}}, \quad y = \frac{\begin{vmatrix} a & m \\ c & n \end{vmatrix}}{\begin{vmatrix} a & b \\ c & d \end{vmatrix}}.$$

Matrix Form

PYTHAGOREAN THEOREM



$$\text{The Proportion: } \frac{a}{m} = \frac{c}{a}$$

$$\text{from where: } a^2 = mc. \quad (1)$$

$$\text{The Proportion: } \frac{b}{n} = \frac{c}{b}$$

$$\text{from where: } b^2 = nc. \quad (2)$$

Also: $m + n = c$.

Adding (1) and (2) gives:

$$a^2 + b^2 = mc + nc = c^2$$

Therefore:

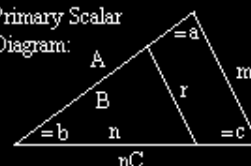
The Pythagorean Theorem

$$\text{is: } a^2 + b^2 = c^2$$

TRANSFORMS. Foundation:

Primary Scalar

Diagram:



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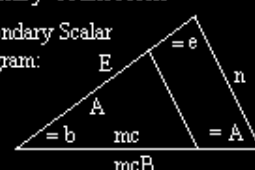
$$ma = nb \frac{mc}{n}; \quad \text{from where: } a = bc.$$

$$\begin{aligned} A &= ma, \quad B = nb, \quad C = \frac{m}{n}c. \\ \text{Primary Ecuations.} \\ A &= BC, \quad a = bc. \\ \text{Secondary Ecuations.} \end{aligned}$$

Primary Transform

Secondary Scalar

Diagram:



Combining: $A = ma$ and $a = bc$

$$\text{gives: } A = mcb \quad \text{or} \quad \frac{A}{mc} = b.$$

Combining: $A = BC$ and $C = \frac{m}{n}c$

$$\text{gives: } B = \frac{n}{mc}A \quad \text{or} \quad \frac{mcB}{n} = A.$$

The Ratios of Similitude are:

$$\frac{E}{n} = e, \quad \frac{A}{mc} = b, \quad \frac{mcB}{n} = A. \quad (3)$$

The Proportion:

$$\frac{E}{mcB} = \frac{A}{mc} \quad \text{from where: } E = AB. \quad (4)$$

Substituting (3) in (4) we get

$$ne = mcb \frac{An}{mc} \quad \text{from where: } e = Ab$$

$$\begin{aligned} E &= (n)e, \quad A = (mc)b, \quad B = \frac{n}{mc}A. \\ E &= AB, \quad e = Ab. \end{aligned}$$

Secondary Transform

P is an Operator readen Proportionally the five formulas of the Transform are taken from the two similar triangles of the Diagram. See Chart of Physics. Page 1

Chart of Mathematics - side 2

Wednesday, June 30, 2010

9:55 PM

ALGEBRA

$$5+5+5=3 \times 5=15.$$

$$a+a+a=3 \times a=3a.$$

$$(a+b+c)=(a+b)+c$$

$$=a+(b+c)=a+b+c.$$

Associative Law of Addition.

$$a+b+c+b=a+2b+c.$$

$$c-2c+3c+d=2c+d.$$

$$5-7=-2=-7+5.$$

$$-2-3-5=-10.$$

$$-e+d=d-e.$$

$$a+b=b+a.$$

Commutative Law of Addition.

$$-a-a-b=-2a-b.$$

$$-3+6-2=1.$$

$$-m+n+2m-3n=m-2n$$

$$a-(b+c)=a-b-c, \text{ or write:}$$

$$a-1(b+c)=a-b-c.$$

$$-4-(-3-2)=1 \quad \text{or write:}$$

$$-4-1(-3-2)=1 \quad \text{multiply:}$$

$$-4+(-1) \times (-3)+(-1) \times (-2)$$

$$\text{sum and solve: } =-4+3+2=1.$$

$$-f-(-g+h)=-f+g-h$$

$$\text{or write: } -f-1(-g+h)=$$

$$-f+(-1)(-g)+(-1)(+h)$$

$$\text{and solve: } =-f+g-h.$$

$$5 \times 5 \times 5=(5)(5)(5)=5^3.$$

$$a \times a \times a=a \times a \times a=(a)(a)(a)$$

$$=a \cdot a \cdot a=a^3.$$

$$a b c=a(b c)=(a b) c=(a c) b$$

Associative Law of Multiplication:

$$-n^2=(-n)^2=n^2.$$

$$a+2b \times b-c=a+2b^2-c$$

$$ab=ba, \quad -ab=-ba.$$

Commutative Law of Multiplication:

$$-c(-b)=-(-b)(-c)=bc.$$

$$a(b+c+d)=ab+ac+ad.$$

distributive Law of Multiplication:

$$d^1 d^2 d^3=d^{(1+2+3)}=d^6.$$

$$b^{-\frac{1}{3}}=\frac{1}{\sqrt[3]{b}}. \quad d^{\frac{1}{2}}=\sqrt{d}.$$

$$e^2 e^{-2}=e^0=1.$$

$$\frac{b}{b^{-2}}=b^{-1}=\frac{1}{b}.$$

$$\log a b=\log (a b)=\log a+\log b.$$

$$\log \frac{a}{b}=\log a-\log b.$$

$$\log d^{-m}=-m \log d.$$

$$\log a^3=3 \log a. \quad \log \sqrt[3]{b}=\frac{1}{3} \log b. \quad \log g^{\frac{1}{n}}=\frac{1}{n} \log g.$$

$$\log \frac{a}{b^{-2}}=b^{-1}=\frac{1}{b}.$$

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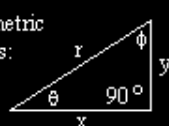
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TRIGONOMETRY

Trigonometric

Functions:



$$\sin \theta=\frac{y}{r} . \quad \csc \theta=\frac{r}{y} .$$

$$\cos \theta=\frac{x}{r} . \quad \sec \theta=\frac{r}{x} .$$

$$\tan \theta=\frac{y}{x} . \quad \cot \theta=\frac{x}{y} .$$

$$\sin \theta=\csc \theta \tan \theta$$

$$\sin ^2 \theta+\cos ^2 \theta=1$$

$$\sin \theta=\cos \phi$$

$$\sin \left(90^{\circ}-\theta \right)=\cos \theta$$

$$\sin ^2 \theta=\left(\sin \theta \right)^2$$

$$\frac{a}{\sin \alpha}=\frac{b}{\sin \beta}=\frac{c}{\sin \gamma}$$

Theorem of Sines.

$$b^2+c^2-a^2=2 b c \cos \alpha$$

Theorem of Cosines.

$$\frac{a-b}{a+b}=\frac{\tan \frac{1}{2}(\alpha-\beta)}{\tan \frac{1}{2}(\alpha+\beta)}$$

Theorem of Tangents.

$$\frac{a}{\sin \alpha}=\frac{b}{\sin \beta}=\frac{c}{\sin \gamma}$$

$$b^2+c^2-a^2=2 b c \cos \alpha$$

$$\frac{a-b}{a+b}=\frac{\tan \frac{1}{2}(\alpha-\beta)}{\tan \frac{1}{2}(\alpha+\beta)}$$

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$$b^2+c^2-a^2=2 b c \cos \alpha$$

$$\frac{a-b}{a+b}=\frac{\tan \frac{1}{2}(\alpha-\beta)}{\tan \frac{1}{2}(\alpha+\beta)}$$

Theorem of Tangents.

USEFUL BINOMIAL PRODUCTS

$$\begin{array}{r} b \\ + \\ a \end{array} \begin{array}{|c|c|} \hline ab & b^2 \\ \hline a^2 & ab \\ \hline \end{array} \begin{array}{c} a \\ + \\ b \end{array}$$

$$\begin{array}{r} a+b \\ \times \\ a+b \\ \hline a^2+ab \\ +ab+b^2 \\ \hline a^2+2ab+b^2 \end{array}$$

Sum of two numbers squared:

RULES OF MULTIPLICATION:

$$(a+b)(a+b)=(a+b)a+(a+b)b$$

$$\text{or: } =a(a+b)+b(a+b)$$

$$\text{yields: } =a^2+2ab+b^2$$

Expanded form:

$$(a+b)(a+b)=(a+b)^2$$

Factor form: Exponential form:

$$\begin{array}{r} a-b \\ \times \\ a-b \\ \hline a^2-ab \\ -ab+b^2 \\ \hline a^2-2ab+b^2 \end{array} \begin{array}{|c|c|} \hline b & b^2 \\ \hline a-b & (a-b)^2 \\ \hline a-b & b \end{array}$$

b^2 is subtracted twice.

Difference of two numbers squared:

$$\begin{array}{r} b \\ + \\ a \end{array} \begin{array}{|c|c|} \hline ab & b^2 \\ \hline a^2 & ab \\ \hline \end{array} \begin{array}{c} a \\ + \\ b \end{array}$$

Conjugate Binomials:

$$\begin{array}{r} a+b \\ \times \\ a-b \\ \hline a^2+ab \\ -ab-b^2 \\ \hline a^2-b^2 \end{array}$$

LAWS OF SIGNS:

$$(+1) \times(+1)=(+1)$$

$$(+1) \times(-1)=(-1)$$

$$(-1) \times(+1)=(-1)$$

$$(-1) \times(-1)=(+1)$$

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Geometry of Physics with Transforms - Table of Contents

Wednesday, June 30, 2010

9:58 PM

INDEX

| | |
|-----------------|------------|
| GLOSSARY..... | page one |
| ALGEBRA..... | page two |
| RATIOS..... | page three |
| SIMILITUDE..... | page four |
| EUCLID..... | page five |

GEOMETRY OF PHYSICS WITH TRANSFORMS BY RODOLFO PADILLA

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Glossary - page 1

Wednesday, June 30, 2010

10:01 PM

SCIENTIFIC GLOSSARY:

1: **PROPOSITION:** is the enunciation of a: axiom, theorem, problem, law, hypothesis. Example: the three heights of a triangle intersects at one point.

2: **AXIOM:** is an evident truth, that it's evidence is the demonstration. Example: the school is greater, than one of it's classrooms.

3: **THEOREM:** is a fact that is evident only by means of a demonstration. Example: the three angles of a triangle sum 180° degrees.

4: **POSTULATE:** is an intuitive principle that is accepted with out can't be demonstrated. Example: the invariability of geometric figures.

5: **LEMA:** is a proposition to facilitate the demonstration of a theorem. Example: π pi is calculated by doubling the sides of a square and so on.

6: **PROBLEM:** is a question that must be solved. Example: relate the Energy formula $E=Fx$ with the Power formula $W=VI$.

7: **SOLUTION:** of a problem, is the indicated method to be solved. Example: derive Ohm's law by means a TRANSFORM.

8: **HYPOTESIS:** is a suposition. Example: mass contracts in the direction of it's movement.

9: **COROLARY:** is a consequence. Example: a perpendicular produces two right angles.

10: **SCHOLIUM:** is an observation. Example: the intersection of the medians in a triangle, is it's center of gravity.

11: **DEMONSTRATION:** are the proofs from reasoning for the conclusion. Example: the foundation of the TRANSFORM.

12: **CONCLUSION:** is what is deduced from the hypothesis by means of the demonstration. Example: the Thales' Theorem.

13: **EXPERIMENT:** is an installation in a laboratory to study and obtain scientific concepts.

Example: the Thermoionic or Edison Effect.

14: **THEORY:** is a work with postulates and laws. Example: the transmission of light.

15: **PREMISE:** are axioms, theorems, or laws, needed for a demonstration. Example: two things equal to a third one, are equal between them.

16: **OPERAND:** is a quantity written with numbers and / or characters, or letters. Example; 57, 3a, der, a^2 , 2ab, b^2 , $3a^4b$, e^3 , mn^5

17: **TERM:** is a quantity or an algebraic expression separated only by the plus + sign minus - sign or equal = sign. Example: $=4aj+$, $-b+$, $-2dc=$

18: **ALGEBRAIC EXPRESSION:** are operands and operators. Example: 33, 24xy, z, $a^2 + 2ab + b^2$.

19: **TRANSFORMATION:** is the conclusion or result of the operands and operators. Example: surface $s = a^2 + 2ab + b^2$.

20: **FORMULA:** is an algebraic expression. Example: $E = mv^2$.

21: **EQUATION:** are two algebraic expressions separated only by the equal = sign. Example: $y = mx + b$, $Ax + By + C = 0$.

22: **ALGEBRA:** is a sciencee that works with algebraic expressions and equalities. Example: $A = ma$, $B = nb$, $C = mn^{-1}c$. $A = BC$, $b = bc$.

23: **COEFFICIENT:** is the number in a term. Example: $=7a^4$, seven is the coefficient.

24: **EXPONENT:** is the power for what to be raised of an algebraic expression. Example: $2b^2$, $(ab)^3$, the small numbers two 2 , and three 3 are powers.

25: **MONOMIO, BINOMIO, TRINOMIO:** algebraic expressions of: one term, two terms, three terms.

26: **OPERATORS:** are the signs for what to do with the operands. Example: signs of operation as:

| SIMBOL: | OPERATION: |
|----------------|---|
| + | To sum or add, plus sign, positive sign. |
| - | To subtract, minus sign, negative sign. |
| \div | To divide, division's sign |
| x | To multiply, multiplication sign. |
| $\sqrt{\quad}$ | Root, square root, cubic root, |
| n | Number: 0, 1, 2, 3,.....-4,.....infinite ∞ |
| n^p | Power, raise to a power: |
| log n | To take the Decimal Logarithm, Briggs. |
| ln n | To take Natural Logarithm, Napier. |
| (ab) | Association sign, parenthesis. |
| = | Equal sign. |
| $\sin \theta$ | sine function, trigonometry. |
| $\cos \theta$ | cosine function, trigonometry. |
| $\tan \theta$ | tg, tangent function, trigonometry. |
| θ | angle: degree, radian, grads. |
| \mathcal{P} | TRANSFORM: PHYSICS. Operator. |
| $\frac{a}{b}$ | Fraction bar, for division. |
| ∞ | Infinite. |

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Algebra - page 2

Wednesday, June 30, 2010

10:02 PM

ALGEBRA: EXPLICITATION.

Muhammed-ibn-Musa Al-khowarizmi. Mathematician and Astronomer lived in Baghdad on IX century. Known for his book Al-jabr w'al-mukabalah, a Treatise on Algebra, means: Book of Equations and Simplification of Terms. Written about the year 825, he died about 850. Much of the logic concepts in algebra used today comes from: Al-khowarizmi.

FIRST LAW OF ALGEBRA: LAW OF EQUALITIES:

"Both sides or members of an equation must be done the same algebraic operations so both sides are always equal". This law is an axiom.

EXPLICITATION:

Each letter of this mathematical or algebraic expression: $A = ma$, may be explicited to get two more formulas. Let's explicit a in the formula:

Divide both members or sides of the equality by the quantity m applying law of equalities, thus:

$$\frac{A}{m} = \frac{ma}{m} \quad \text{arrange:} \quad \frac{A}{m} = \frac{m}{m} a$$

$$\text{observe that: } \frac{m}{m} = 1 \quad \text{therefore:} \quad a = \frac{A}{m}$$

a has been explicit.

Explicit m in the same formula: divide both sides by a applying equality's law again, thus:

$$\frac{A}{a} = \frac{ma}{a} \quad \text{or:} \quad \frac{A}{a} = m \frac{a}{a}$$

$$\text{simplify: } \frac{a}{a} = 1 \quad \text{and finally:} \quad m = \frac{A}{a}$$

m is explicit. The three formulas are:

$$A = ma \quad a = \frac{A}{m} \quad m = \frac{A}{a}$$

Explicit n in the formula: $C = \frac{m}{n} c$

multiply both sides by n thus: $nC = n \frac{m}{n} c$

$$\text{arrange: } nC = \frac{n}{n} mc \quad \text{simplify: } nC = mc$$

$$\text{divide both sides by: } C \quad \text{thus:} \quad \frac{nC}{C} = \frac{mc}{C}$$

$$\text{arrange: } n \frac{C}{C} = \frac{mc}{C} \quad \text{finally: } n = \frac{mc}{C}$$

n has been explicit.

DIVISION: LAWS OF DIVISION:

The division of two numbers gives other number called QUOTIENT or RATIO. Notations, and names of the parts of the division:

$$\begin{array}{c} \text{quotient} \\ \text{divisor} \overline{) \text{dividend}} \end{array} \quad \frac{\text{numerator}}{\text{denominator}} = \text{ratio}$$

division notation

fraction notation

$$800 \div 125 = 6.4$$

arithmetic notation

$$84(2)^{-1} = 42$$

exponential notation

FIRST LAW OF DIVISION:

When the dividend and divisor are multiplied by the same number, the quotient is the same as before. Example;

$$5.25 \overline{) 1.3} = \frac{1.3}{525 \overline{) 700}} = \frac{1.33333...}{525 \overline{) 700.00000}}$$

This law is useful for solving arithmetic divisions.

SECOND LAW OF DIVISION:

When numerator and denominator are divided by the same number the ratio is the same as before. Example:

$$1.5 = \frac{3}{2} = \frac{3 \overbrace{) 9}^{\text{divided by 10}}}{2 \overbrace{) 6}^{\text{divided by 10}}} = \frac{3 \overbrace{) 90}^{\text{divided by 10}}}{2 \overbrace{) 60}^{\text{divided by 10}}} = \frac{3 \overbrace{) 270}^{\text{divided by 10}}}{2 \overbrace{) 180}^{\text{divided by 10}}} = \frac{3 \overbrace{) 540}^{\text{divided by 10}}}{2 \overbrace{) 360}^{\text{divided by 10}}} = \frac{3 \overbrace{) 180}^{\text{divided by 10}}}{2 \overbrace{) 120}^{\text{divided by 10}}} = \frac{3 \overbrace{) 90}^{\text{divided by 10}}}{2 \overbrace{) 60}^{\text{divided by 10}}} = \frac{3 \overbrace{) 45}^{\text{divided by 10}}}{2 \overbrace{) 30}^{\text{divided by 10}}} = \frac{3 \overbrace{) 22.5}^{\text{divided by 10}}}{2 \overbrace{) 15}^{\text{divided by 10}}} = \frac{3 \overbrace{) 11.25}^{\text{divided by 10}}}{2 \overbrace{) 7.5}^{\text{divided by 10}}} = \frac{3 \overbrace{) 5.625}^{\text{divided by 10}}}{2 \overbrace{) 3.75}^{\text{divided by 10}}} = \frac{3 \overbrace{) 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Ratios - page 3

Wednesday, June 30, 2010

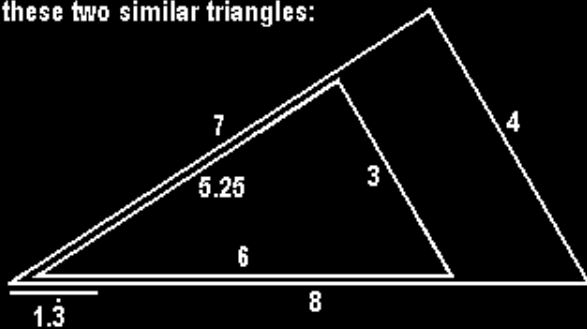
10:03 PM

RATIOS AND PROPORTIONS:

Geometry are the pictures of Physics and Mathematics. Two Equal Ratios form a Proportion.

PROPORTIONS are related with problems in arithmetic, algebra, physics, chemistry, and more.....

COMPUTE all measurements related to the sides of these two similar triangles:



The division of parallel sides have the same value of ratio for each set of similar triangles:

$$\frac{8}{6} = 1.\dot{3} \quad \frac{4}{3} = 1.\dot{3} \quad \frac{7}{5.25} = 1.\dot{3}$$

Observe that: $1.\dot{3} = 1.33333...$

Large sides divided by small sides have the same ratio:

$$\frac{8}{4} = 2 \quad \frac{6}{3} = 2$$

Middle sides divided by large sides give same ratio:

$$\frac{7}{8} = 0.875 \quad \frac{5.25}{6} = 0.875$$

Middle sides divided by small sides give same ratio:

$$\frac{7}{4} = 1.75 \quad \frac{5.25}{3} = 1.75$$

Make proportions equaring equal ratios:

$$\frac{8}{6} = \frac{4}{3} \quad \frac{8}{6} = \frac{7}{5.25} \quad \frac{4}{3} = \frac{7}{5.25}$$

$$\frac{8}{4} = \frac{6}{3} \quad \frac{7}{8} = \frac{5.25}{6} \quad \frac{7}{4} = \frac{5.25}{3}$$

You can commute numerator with denominator:

$$\frac{6}{8} = \frac{3}{4} \quad \frac{6}{8} = \frac{5.25}{7} \quad \frac{3}{4} = \frac{5.25}{7}$$

$$\frac{4}{8} = \frac{3}{6} \quad \frac{8}{7} = \frac{6}{5.25} \quad \frac{4}{7} = \frac{3}{5.25}$$

to check for correctness of proportion: multiply cross sense, thus: $8 \times 3 = 4 \times 6$.

Problems related with proportions:

1) Seven candies cost 4 cents, how much cost a box of 525 candies?

arrange data as a proportion format:

| | |
|-------------------------------|---|
| up candies | operation: |
| $\frac{7}{4} = \frac{525}{?}$ | $\frac{525 \times 4}{7} = 300 \text{ cents} = 3 \text{ dollars.}$ |
| down cents | |

or:

$$525 \times 4 \div 7 = 300 \text{ cents} = 3 \text{ dollars.}$$

2) A car runs a mile in one and a half minute, how much time needs the car to cover 165 miles?

| | |
|---------------------------------|--|
| up miles | |
| $\frac{1}{1.5} = \frac{165}{?}$ | $165 \times 1.5 \div 1 = 247.5 \text{ minutes.}$ |
| down minutes | |

3) How many hours are 247.5 minutes? You know one hour is 60 minutes:

| | |
|----------------------------------|---|
| up hours | |
| $\frac{1}{60} = \frac{?}{247.5}$ | $247.5 \times 1 \div 60 = 4.125 \text{ hours.}$ |
| down minutes | |

4) How many minutes are in 0.125 of an hour? You know that $0.125 = 1/8$ of an hour.

| | |
|----------------------------------|--|
| up hours | |
| $\frac{1}{60} = \frac{0.125}{?}$ | $0.125 \times 60 \div 1 = 7.5 \text{ momites}$ |
| down minutes | |

5) How long lasted the trip in hours minutes and seconds? You know half minute 0.5 are 60 seconds. The trip lasted: 4 hours, 7 minutes, and 30 seconds.

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for High School and up.

Similitude - page 4

Wednesday, June 30, 2010
10:05 PM

SIMILITUDE

PROOF OF RATIO OF SIMILITUDE:

Thales, states that two triangles are similar when each of the angles of one triangle equals correspondingly to the angle of the other triangle.

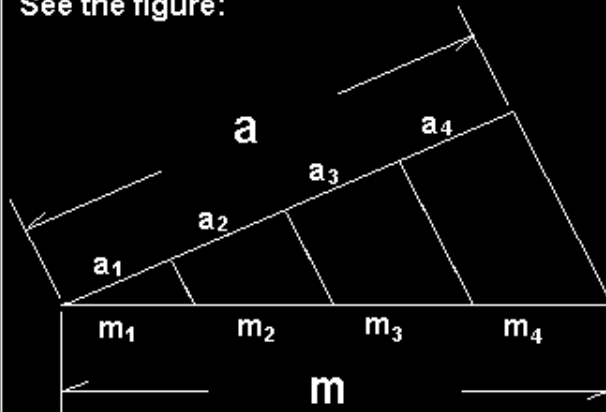
This is a ratio, the distance a_1 divided by the distance m_1 :

$$r = \frac{a_1}{m_1}$$

r is the value of the ratio.

This is a ratio of similitude: $r = \frac{a_1 + a_2}{m_1 + m_2}$

See the figure:



The distances are equal so the ratios are equal:

$$r = \frac{a_1}{m_1} = \frac{a_2}{m_2} = \frac{a_3}{m_3} = \frac{a_4}{m_4}$$

It is required to prove that:

$$\frac{a}{m} = \frac{a_1 + a_2 + a_3 + a_4}{m_1 + m_2 + m_3 + m_4} = r$$

and / or:

$$\frac{a}{m} = \frac{a_1}{m_1}$$

Proceeding as follows:

Starting with:

$$r = \frac{a_1}{m_1} = \frac{a_2}{m_2} = \frac{a_3}{m_3} = \frac{a_4}{m_4}$$

Equating each term in this way:

$$r m_1 = a_1, \quad r m_2 = a_2,$$

$$r m_3 = a_3, \quad r m_4 = a_4.$$

The sum of the right members of these equations are equal to the sum of the left members of these equations:

$$\begin{aligned} a_1 + a_2 + a_3 + a_4 \\ = r m_1 + r m_2 + r m_3 + r m_4. \end{aligned}$$

r is a common factor, then:

$$\begin{aligned} r (m_1 + m_2 + m_3 + m_4) \\ = a_1 + a_2 + a_3 + a_4 \end{aligned}$$

expliciting r follows:

$$r = \frac{a_1 + a_2 + a_3 + a_4}{m_1 + m_2 + m_3 + m_4}$$

As has been seen:

$$a = a_1 + a_2 + a_3 + a_4$$

and:

$$m = m_1 + m_2 + m_3 + m_4$$

therefore:

$$\frac{a}{m} = \frac{a_1 + a_2 + a_3 + a_4}{m_1 + m_2 + m_3 + m_4}$$

also:

$$\frac{a}{m} = \frac{a_1}{m_1} = \frac{a_2}{m_2} = \frac{a_3}{m_3} = \frac{a_4}{m_4} = r$$

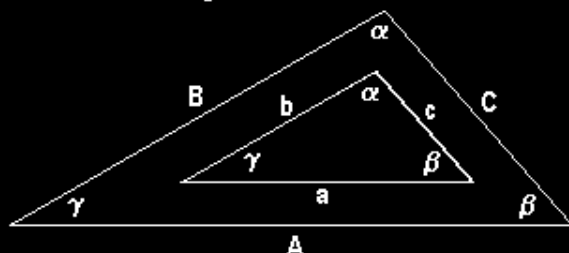
The ratio of similitude has been proven!

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EUCLIDEAN GEOMETRY. SIMILAR TRIANGLES:
EUCLID, a Greek Mathematician lived on 365? to 275? before Christ. Famous for his Book of **THE ELEMENTS** a treatise on geometry, written on 330 before Christ. Geometry as we know today comes from **EUCLID**.

LAWS OF SIMILAR TRIANGLES:

Two or more triangles are similar when:



LAW OF ANGLES of similar triangles:

The **ANGLES** of similar triangles are correspondingly equal. That's all. This definition of similar triangles is sufficient. Correspondingly means that:

- 1) The value α of large angle of big triangle is equal to the value α of large angle of little triangle.
- 2) The value β of middle angle of big triangle is equal to the value β of middle angle of little triangle.
- 3) The value γ of small angle of big triangle is equal to the value γ of small angle of little triangle.

LAW OF SIDES AND ANGLES of similar triangles:

- 1) Large side is opposite to large angle.
- 2) Middle side is opposite to middle angle.
- 3) Small side is opposite to small side.

LAW ONE OF SIDES of similar triangles:

The **SIDES** of similar triangles are parallel. To do so: translate and or rotate one triangle. That's all. This definition of similar triangles is sufficient. Similar figures with parallel sides are **HOMOTETIC**.

LAW TWO OF SIDES of similar triangles:

The **SIDES** of similar triangles correspondingly have the same **RATIO of QUOTIENT**. That's all. This definition of similar triangles is sufficient. Correspondingly means that:

- 1) The length A of large side of big triangle divided by the length a of large side of little triangle have a ratio or quotient.
- 2) The length B of middle side of big triangle divided by the length b of middle side of little triangle have the same ratio or quotient as before.

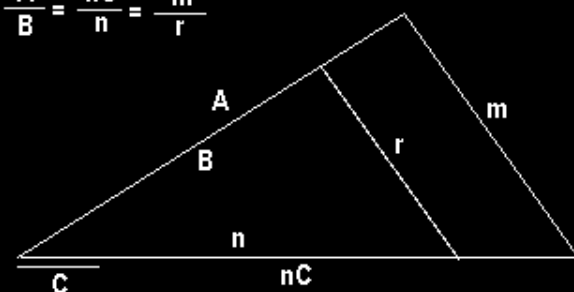
NEW PROOF OF THALES THEOREM:

THALES: Mathematician born 624? - 548? before Christ, in Samos island, near Miletus east of Mediterranean sea. Known as traditional extant until Plato 427 - 347 before Christ.

Prove or demonstrate **THALES THEOREM:** that the quotient or ratio, of the three parallel sides of two similar triangles, have the same value.

Prove or Derive that:

$$\frac{A}{B} = \frac{nC}{n} = \frac{m}{r}$$



Write valid mathematical proportions:

$$\begin{aligned} \frac{A}{m} = \frac{B}{r} &\rightarrow \frac{A}{B} = \frac{m}{r} \\ \frac{A}{nC} = \frac{B}{n} &\rightarrow \frac{A}{B} = \frac{nC}{n} \end{aligned} \rightarrow \frac{A}{B} = \frac{nC}{n} = \frac{m}{r} = C$$

All quotients have the same ratio equal to $=C$.

The **THALES THEOREM** has been demonstrated.

Observe that the Geometric Diagram or figure, is the same of the page "The Transform", in the "SCIENTIFIC CHART OF PHYSICS WITH TRANSFORMS".

- 3) The length C of small side of big triangle divided by the length c of small side of little triangle have the same ratio or quotient as others sides.

SCHOLIUM:

- 1) Each set of similar triangles have its own **RATIO**
- 2) Similar triangles are when correspondingly have two equal angles, the third angle automatically will be equal.

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About Me - Rodolfo Padilla Avalos

Wednesday, June 30, 2010
10:09 PM

Physics with Transforms by Rodolfo Padilla

About Rodolfo Padilla Avalos



About the author:

RODOLFO PADILLA began to be acquainted with electronics since childhood. During elementary school he liked to make experiments with a box of little lamps, coils, transformers, wires, and batteries in a corner of his bedroom. He followed plans from books and magazines that his friends gave him. He liked to listen to the radio at bed time with a Galena Radio that he built, using the window screen as an antenna. He loved to build heterodyne circuits with electronic tubes.

During the next five years of middle and high schools he continued experimenting and building electronic projects, and loved mathematics. A teacher encouraged him to build a radio frequency oscillator and to present it in the physics science fair. That year, 1955, he received his Bachelor's degree in Physics and Mathematical Sciences. He liked to make experiments and projects with transistors.

He graduated from the ESCUELA MEXICANA DE ELECTRICIDAD, receiving his degree as a radio and television technician in 1965. He continued studying and investigating more physics-related mathematics. On 1971 he published Physics with Transforms, a "treatise on conduction".

On 1980 he graduated from Cleveland Institute of Electronics (<http://www.cie-wc.edu/>), receiving his degree in electronic engineering. On 1991 he published papers concerning experiments on electronic circuits. Chemistry with notes of all types of batteries, mathematics and physics. He continues making experiments and projects on electronics.

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8:45 PM

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